(12) UK Patent Application (19) GB (11) 2 226 214 (13) A

(43) Date of A publication 20.06.1990

(21) Application No 8924669.8

(22) Date of filing 02.11.1989

(30) Priority data
(31) 03269 (32) 07.11.1988 (33) ES

(51) INT CL[5]
H04R 1/30

(52) UK CL (Edition K)
H4J JBA J30F J30L J33E J33K

(56) Documents cited
GB 2211377 A GB 1069758 A GB 0327759 A
WO 83/02539 A1 WO 83/00977 A1

(58) Field of search
UK CL (Edition J) H4J JAB JBA JEP, H4X X3
INT CL[4] H04R 1/00 1/02 1/20 1/22 1/24 1/26 1/28 1/30

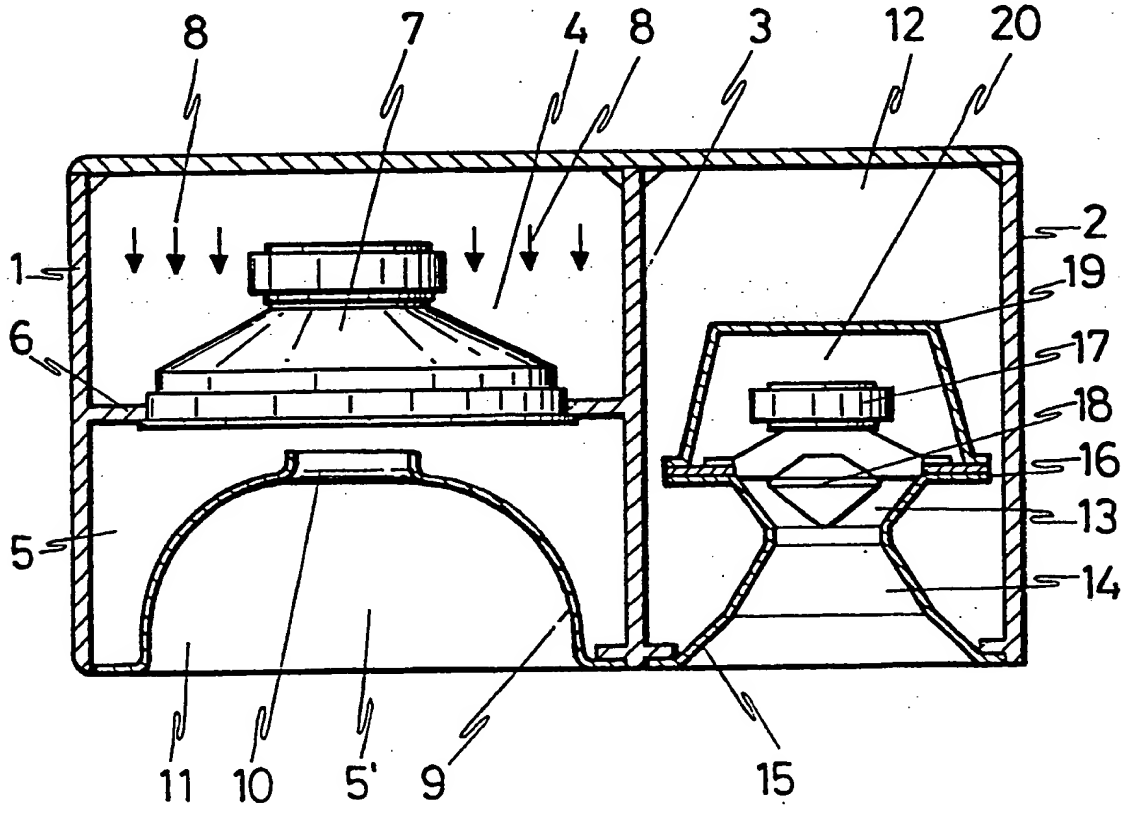
(71) Applicant
Javier Gadea Veses
14 Pintor Astorza Y Triay, 03015 Alicante, Spain

(72) Inventor
Javier Gadea Veses

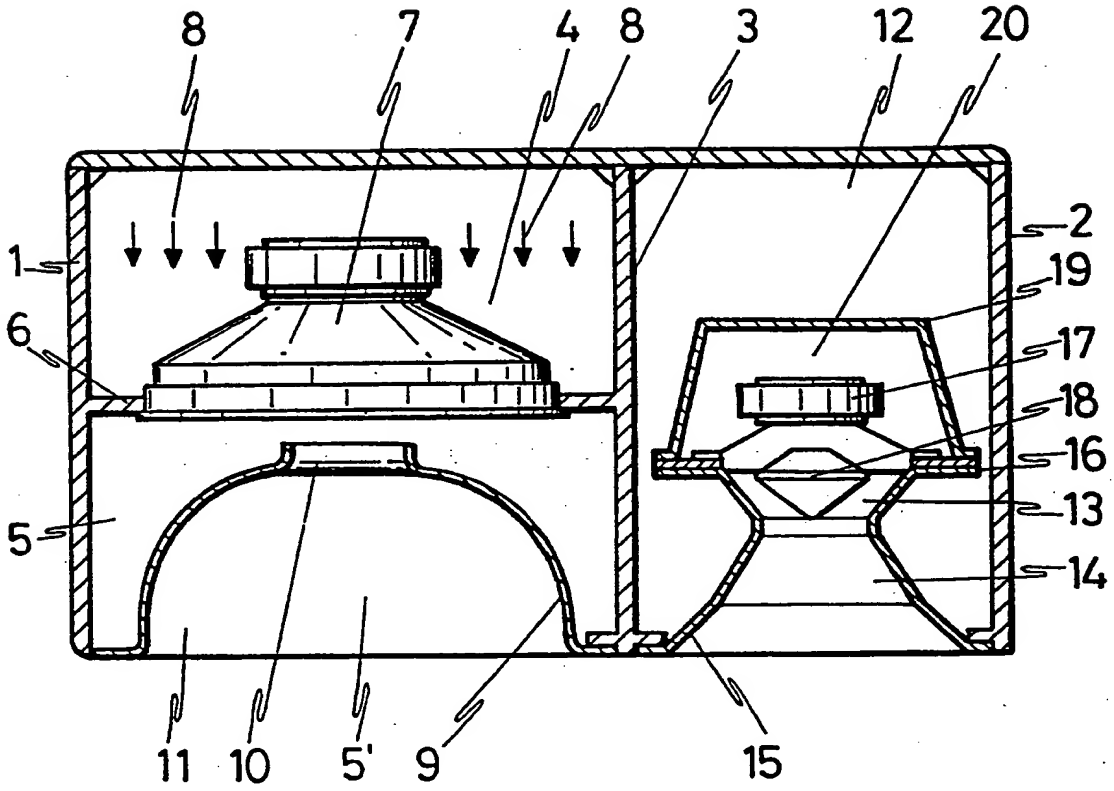
(74) Agent and/or Address for Service
Edward Evans & Co
Chancery House, 53-64 Chancery Lane, London,
WC2A 1SD, United Kingdom

(54) Loudspeaker enclosure

(57) A loudspeaker enclosure comprising high and low frequency compartments of which the low frequency compartment 1 is divided into compartments 4, 5 bounding respectively the front and rear of the low frequency loudspeaker 7. The front sub-compartment contains an acoustic horn, the volume between the horn and the mouth of the loudspeaker forming a pneumatic stabilizer 5 whereas the volume in front of the horn 9 forms an acoustic transformer 5'. In the high frequency compartment 2, the output of the high frequency loudspeaker 17 passes through a bi-conical horn 13, 14 which first reduces and then increases in diameter and is diffused by a bi-conical diffuser 18 which first increases and then decreases in diameter with increasing distance from the loudspeaker.



GB 2 226 214 A


8
7
4
8
3
12
20
1
2
19
6
17
18
16
13
5
14
11
10
5'
9
15

ACOUSTIC BOX FOR SOUND TRANSDUCTION

DESCRIPTION

PURPOSE OF THE INVENTION

This invention is referred to an acoustic complex for sound transduction, a box where two independent areas are adjusted, one of them as a low sound unit, it means, for low frecuencies, and the other one for medium-high frecuencies or medium and high frecuencies, it means, with the characteristic that in the first case the area is devided into two parts or chambers separated by a sounder screen where it is adjusted the transducer, being this one placed in one of the chambers, while the other one incorpores the assembly of a bobbin. In the second case, it means, the medium-high unit or medium and high it incorpores a biconical bobbin which it is completed with a diffuser and a sealed bell that works as chamber of the transducer, being adjusted inside of it.

BACKGROUNG OF THE INVENTION

Sound transduction is the final stage of the chain of phenomenons that starts when an analog or digital activeted magnetic tape, a disc recorded into grooves, or an optically recorded base, is explored by its corresponded reader, in such a way that the reader emits electrically interpreted signals to be later filtrated, treated and amplified, by means of the correspondent transducer, in order to be converted into a new sound.

Electroacoustic tranducers or speakers, are based on a mobil bobbin associated to the correspondent magnet and to a membrane or cone, all assambled on a support structure.

The mentioned mobil bobbin receives the electrical sound signal, generating a variable magnetic field that produces repulsions in respect to the field generated by the fixed magnet, and since this one is jointed to the frame, while the bobbin is jointed to the membrane or cone, and also this cone is fixed to the frame, it results that the shifts of the mentioned bobbin are translated into motions of the membrane or cone, and consecuently it is produced the correspondent sound when the air masses are shifted.

In other aspects, it must be taken in account that the most important quality of a sound transducer is that it must produce a sound the most similar possible sound to the one generated in the source, and consecuently reproducing this sound without introducing any distortion factor.

In this way, it has been demonstrated that with a sole speaker it is impossible to cover all the range of audible frecuencies, and consecuently it must be resorted to big diameter speakers for the low frecuencies, known as woofers, while for higher frecuencies it is employed speakers of smaller dismeter, known as tweeters.

Also it must be taken in account that a speaker emits sounds into two opposit directions, one of them considered as rear and the other one as frontal, being produced in between the air volumes contained between the two parts some mixtures that interfers the vibrations.

There is no doubt that solution to avoid this problem would consist in separate both parts by a sounder screen, in such a way that each one of the generated waves would go to different sides of it. This screen, denominated infinite screen, is impossible to be carried out in the practice, and consecuently it is resorted to the classic acoustic box where it is tried to eliminate the rear wave.

One of the characteristics of the acoustic box is the one related to the air contained inside of it, because, since it is sealed, the movement of the correspondent speaker membrane produces a compression of the internal air, being this one negligible if it is enough high, while in the contrary case, the mentioned compression of the air will affect the membrane; it means, it will always exist a minimum box volume where at a lower level it will be not obtained a good reproduction.

Consecuently, it is evident that one of the problems to be solved in the acoustic boxes is its size, and another problem is the phases, in such a way that the different wavelenghts will arrive compensated to the listeners, presenting a phase combination very similar to the original sound with the highest possible directivity.

These problems change according to the acoustic complex, formed by two or more transducers, each one alocated in its acoustic box, so if it is used outdoors or indoors it will change according to the place, depending on the acoustic conditioning, and it will increase according to the acoustic power used it each case.

When they are proffesional acoustic complexes for places such as discotheques, auditoriums or outdoors, it is undertood that these acoustic boxes must have a big size and weight, something that complicates both the transport and the assambly.

DESCRIPTION OF THE INVENTION

The acoustic box for sound transduction, carried out according to the objection of the invention, has been conceived to solve these problems, offering such a structure that for similar power it presents a 50% smaller volume than those actually exisiting in the market and a 20% lower weight, and consecuently this acoustic box, with a similar size to other classical ones, gives a higher power, a more plane response and also offers a lower distorsion and a constant directvity, and all this as a consecuence of a better distribution of the sound spectrum as it is here explained.

In a more specific way, the acoustic box constitues a hollow body that it is devided into two areas or units, one of them denominated low unit and the other one denominated medium-high or medium and high unit.

The low unit determines an area devided into two parts or chambers, as a consecuence of an intermediate sounder screen, incorporing the rear chamber a horn, which its internal mouth is equal or smaller to the one of the membrane correspondent to the transducer adjusted on the referred sounder screen, transducer that it is placed inside the other chamber. By other part, the mouth of the referred transducer is also equal or smaller to the external one of the horn.

This disposition and physical structure of the mentioned components allows a pneumatic stabilization of the transducer membrane, balancing the rear weight and giving a better raised work in the extreme low or sub-low, constituting also an acoustic transformer that increases the capacity in the low ones in alignement in respect to the final response.

The pneumatic stabilizer, constituted by the part of the chamber that it is between the sounder screen and the horn, allows the reduction of the total volume of the area without producing any acoustic short-circuit, it means, inmobilization of the transducer membrane.

Referred to the medium-high unit or medium and high, this one includes a horn, preferably biconical, where the two parts of this horn are joined by its smaller base.

The part of horn considered as the internal one is extended perimetrically in a wing which constitutes a support-mean for a biconical diffuser and for a sealed bell that works as a chamber of the transducer which it is adjusted on the referred wing of the internal part of the horn.

This incorporated biconical diffuser works as a phase corrector and collaborates in the distribution of the potential in a vertical way.

The preceding pages of the description can be alternatively expressed as follows:

This invention relates to a loudspeaker ~~and~~ enclosure divided into a low frequency compartment and a high frequency compartment. Such compartments are used in order to prevent distortion of the sound waves generated by the loudspeaker through interference between the sound emitted by the front of the loudspeaker and the sound emitted by the rear of the loudspeaker. Ideally, an infinite plane barrier should extend around the mouth of the loudspeaker to prevent the sound emitted from the rear from reaching the listener, but this clearly impractical. Loudspeaker enclosures are therefore provided in order to absorb as far as possible the sound waves emitted from the rear of the loudspeaker but in order to do this efficiently, and without reflecting loading back to the loudspeaker thereby affecting its performance, loudspeaker enclosures usually have to be of large size and high density.

The present invention attempts to overcome the problems of size and weight and provides a loudspeaker enclosure as set out in Claim 1.

DESCRIPTION OF THE DRAWINGS

To complete this description and in order to help to a better understanding of the characteristics of the invention, it is joined to this descriptive brochure, as a whole part, a sole sheet of plans, where as an illustrative and non-limitative character, it has been represented a transversal section of the acoustic box with the components that forms it.

PREFERRED REALIZATION OF THE INVENTION

As it can be seen in the figure, it is observed how the acoustic box of the invention includes two areas 1 and 2, totally independent and separated by an intermediate wall 3, areas that constitutes the correspondent units of low and medium-high or medium and high.

The area 1, or low unit, is devided into two chambers 4 and 5, aproximately and preferably equal, by means of a sounder screen 6, being this one equipped with the correspondend hollow to adjust the transducer 7, which offers a rear compression weight shown by the arrows 8 in the chamber 4, while in the rear part it incorpores a horn 9 that could be parabolic, conical, exponential or hyperbolic, that do not congeniate with the transducer 7, being this one adjusted in the area 1, as it is shown in the figure.

The mentioned horn 9, presents an internal mouth 10, that must be equal or smaller to the membrane mouth of the tranducer 7, while the mounth of this last one must be equal of smaller to the external mouth 11 of the horn 9.

As a consecuence of the adjusting of this horn 9, in the chamber 5 it is also determined two sub-chambers, one of them in the horn 9 and the screen 6 and the one referred with 5' and that corresponds to the hole determined by the horn 9, in such a way that the general chamber 5 is the addition of the mentioned internal chamber and of the external chamber or reference 12 of the horn.

The horn determined between this horn 9 and the sounder screen 6 constitutes a pneumatic stabilizer of the transducer membrane 7, balancing the rear weight 8 and incorporing a better shape in the extreme low or sub-low, while the part of the chamber 5' or the correspondent to the horn 9 constitutes an acoustic transformer that elevates the capacity in the low ones, in alignament in respect to the final response.

In this way, the before mentioned pneumatic stabilizer allows the reduction of the total volume of the area, without producing acoustic short-circuit, it means, inmobilization of the membrane of the transducer 7.

In relation with the area 2 or medium-high or medium and high unit, inside of it, it is determined a chamber 12, and in it, it is adjusted a biconical horn constituted by two parts 13 and 14, joined by its smaller bases, with the characteristic that the part of the horn 14 is the one that it is adjusted to the mounth of the area 2, and to do it, this part 14 of the horn, presents its rear border bordered according to the reference 15, shown in the referred figure.

The internal part of the horn 13, is extended in a wing 16, constituting a seat for the transducer 17 and a support for the biconical diffuser 18, separating the bigger part of it by a central chain that by means of the emerging and radial branches is joined to the wing 16, also supporting a sealed bell 19 that works as a chamber of the transducer 17.

According to this structure, the biconical diffuser 18 works as phase corrector and joinly with part of the area 13, distributes the potential in a vertical way in the narrowness that forms the biconical 13-14 of this horn. This diffuser 18 must be as near as possible to the piston of the transducer 17 without obstructing the maximum movement of it.

The rear weight of the mentioned transducer 17 keeps contained in the chamber 20 formed by the sealed bell 19, constituting a syntonized area, while the front weight keeps distributed in benefit of directivity and of the major presence in respect to the total spectrum by the diffuser and its horn.

In a maximum reduction of the chamber 4 correspondent to the first unit or area 1, in respect to the addition of the other two chambers of this area 1, it is forseen hollows or windows in the same intermediate wall 3 that separates both areas or units.

It is not considered as necessary to do á longer description in order to be understood by a person skilled in this area and to understand the advantages of it.

The materials, shape, size and disposition of the elements could be varied, if it means no sustantive alteration of the invention.

The terms used in the description of this brochure must be taken in the widest possible way and in a non limitative way.

The description of the preferred embodiment with reference to the drawing can be expressed in another way:

A loudspeaker enclosure is divided by an intermediate wall 3 into a high frequency compartment 2 and a low frequency compartment 1. The low frequency compartment 1 has an intermediate division 6 encircling the mouth of the low frequency loudspeaker 7, the volume 4 around the rear of the loudspeaker 7 being totally enclosed and the volume 5 in front of the loudspeaker being partly defined by a dome-shaped horn 9 having a central orifice 10 aligned with the axis of the loudspeaker 7. The horn 9 can be parabolic, conical, exponential or hyperbolic. The volume between the screen 6 and the horn 9 provides a pneumatic stabilizer for the loudspeaker 7, balancing the impedance of the rear chamber 8. The volume enclosed by the horn 9 acts as an acoustic transformer for the output of the loudspeaker 7.

The high frequency loudspeaker 17 in the volume 2 is provided with a bi-conical horn on its output side, the first frusto-conical portion 13 being of reducing diameter and the second portion 14 being of increasing diameter with increasing distance from the loudspeaker 17. There is a short cylindrical portion between the portions 13 and 14 and portion 14 has an outer part of larger half-angle than the inner part.

A bi-conical diffuser 18 located in the mouth of the loudspeaker 17, having a first frusto-conical portion tapering towards the loudspeaker 17 and a second conical portion tapering outwardly.

The mouth 15 of the horn portion 14 is mounted on the walls of the loudspeaker enclosure to support the loudspeaker 17 within the compartment 2. A sealed bell 19 encloses the rear of the loudspeaker 17.

It would be possible to provide apertures in the wall 3 which separates the compartment 2 from the rear sub-compartment 4 of the low freqency enclosure in order to keep the size of the enclosure to minimum.

CLAIMS:

1. A loudspeaker enclosure divided into high and low frequency compartments, the low fregency compartment having a rear sub-compartment into which the rear of the low frequency loudspeaker opens and a front sub-compartment provided with a pneumatic stabilizing horn in front of the mouth of the loudspeaker, the horn also acting as an acoustic transformer for the loudspeaker output, a bi-conical horn in front of the high frequency loudspeaker formed by two frusto-conical portions joined at their minimum diameters and a bi-conical diffuser in the output of the high frequency loudspeaker formed by two conical portions joined together at their largest diameters.

2. An enclosure as claimed in Claim 1 wherein the low frequency loudspeaker has a membrane whose diameter lies between the diameter of the central aperture of the horn and the maximum diameter of the horn.

3. A loudspeaker enclosure substantially as hereinbefore described with reference to the accompanying drawing.

4. An acoustic box for sound transduction, including two sound areas and separated by the correspondent wall , forming the area the correspondent low unit, while the area constitutes the medium-high unit or medium and high unit, and incorporing in both areas the respective transductor to convert the correspondent signals into sound, essentially it is characterized because the area is diveded into two chambers and , aproximately equal, by means of a sounder screen , where it is assambled the correspondent transducer , being be forseen that in the rear chamber the assambly of a horn ' duly adjusted, which it is independent of the tranducer , in such a way that the part of the chamber placed between the screen and the surface , constitutes a pneumatic stabilizer of the membrane of the transducer , balancing the rear compression weight , and giving a better raised work in the extreme of low or sub-low, while the chamber determined by the horn constitutes an acoustic transformer that increases the capacity in the low ones in alignation in respect to the final response; with the characteristic that the area that constitutes the unit of medium-high or medium and high incorpores a biconical horn formed by two parts . and . joined by its smaller bases in such a way that the front part of the horn . is frontly extended in a seized way ;, through which it is assambled on the entrance of the correspondent area , while the part : is extended in a wing :- which contitutes a fixing mean of a biconical diffuser , of the transducer and of a sealed bell ·, all this in such a way that the biconical diffuser \ acts as a corrector of the phases and as a mean to distribute the potential in a vertical way.

5. An acoustic box for sound transduction according to claim 1, characterized because the internal mouth \. of the horn \ correspondent to the first area . has a diameter equal or smaller to the mouth correspondent to the membrane of the transducer , and this last one is equal or smaller to the external mouth pertening to the mentioned horn . .

6. An acoustic box for sound transduction, according to claim 1, characterized because the biconical diffuser \. of the second area presents its bigger joining bases separated by a central chain from which derives branches to vinculate the complex to the correspondent wing : of the internal part \ correspondent to the biconical horn, being forseen that the chamber ·|, that forms the sealed bell , determines the mean to content the rear weight of the transducer ' , forming also a syntonized area, while the frontal weight of the mentioned transducer keeps distributed in benefit of directivity.

Published 1990 at The Patent Office, State House, 66 71 High Holborn, London WC1R 4TP Further copies may be obtained from The Patent Office Sales Branch, St Mary Cray, Orpington, Kent BR5 3RD. Printed by Multiplex techniques ltd. St Mary Cray, Kent. Con. 1 87